Ground Water, Surface Water, and Leachate

Physical Barriers

Introduction:

Subsurface barriers involve upright excavated trenches packed with slurry. The slurry, more often than not a mixture of bentonite and water, hydraulically shores the trench to stop collapse and slows down ground water flow.

Description:

Physical barriers are utilised in order to control contaminated ground water. These barriers comprise of a vertically excavated trench that is filled with a slurry. Slurry walls are used in situations where the waste mass is too much for treatment and soluble and mobile contaminants create risk to sources of drinking water.

Slurry walls are technologies that have been used for years as long-term resolutions for controlling seepage. They are regularly used in combination with capping with the majority of slurry walls being constructed of a soil, bentonite, and water mixture. The bentonite slurry is used for wall stabilisation throughout trench excavation. A soil-bentonite backfill material is then sited in the trench (displacing the slurry) to generate the cut-off wall. Walls of this make-up provide an obstruction with low permeability and chemical resistance at low cost. Other wall compositions, for example cement/bentonite, pozzolan/bentonite or slurry/geo-membrane composite, might be exploited if greater structural strength is needed or chemical incompatibilities between the bentonite and contaminants that exist on the site in question.

The walls are placed at depths of up to 30 meters (100 feet) and are 0.6 to 1.2 meters (2 to 4 feet) in thickness. Installation depths over 30 m (100 ft) are possible through use of clam shell bucket excavation, but the cost per unit area of wall increases by almost a factor of three. The most successful application of a wall for site remediation or contaminant control is to base the wall 0.6 to 0.9 meters (2 to 3 feet) into a low permeability layer like clay or bedrock. This offers an effective groundwork with minimum leakage likely. An alternate construction for wall installation is a "hanging" wall where the wall protrudes into the ground water table to impede the movement of lower density or floating contaminants for instance oils, fuels, or gases.

Applicability:

Slurry walls are utilised to contain contaminated ground water, divert contaminated ground water away from drinking water and uncontaminated ground water, and to provide an overall barrier for the ground water treatment system.

Limitations:

- As a rule the approach involves a large amount of heavy construction.
- The technology only contains contaminants within a specific area.
- Soil-bentonite backfills are not proficient at withstanding attack by strong acids, bases, salt solutions, and some organic chemicals.
- There is potential for slurry walls to degrade or deteriorate over time.
- This technology does not assure that further remediation in the future may not be needed.

Data Needs:

Issues that ought to be considered before designing a soil-bentonite slurry wall include maximum acceptable permeability, likely hydraulic gradients, wall strength, availability and grade of bentonite, boundaries of contamination, characteristics such as depth, permeability and continuity of substrate into which the wall is keyed, characteristics of backfill material (e.g. content of fines), and site terrain and physical layout.

Performance Data:

Slurry walls have been exploited for years, making the equipment and methodology easily available and well known. Nevertheless, the procedure of designing the appropriate mix of wall materials to contain specific contaminants is less well developed. Excavation and backfilling of the trench is important and necessitates experienced contractors.

Cost:

Costs liable to be suffered in designing and installing a standard soil-bentonite wall in soft to medium soil vary from £ 380 to £ 520 per square meter. These costs overlook costs involved with chemical analyses or feasibility testing. The costs of feasibility testing depend on site-specific factors. Factors that have the greatest impact on the final cost of a soil-bentonite based wall include:

- Type and distribution of contaminants.
- Depth, length, and width of wall.
- Geological and hydrological characteristics.
- Distance from source of materials and equipment.
- Needs for wall protection and maintenance.
- Type of slurry and backfill used.
- Other site-specific requirements as identified in the initial site assessment namely the presence of debris.
- Planning, permitting, regulatory dealings, and site reinstatement.